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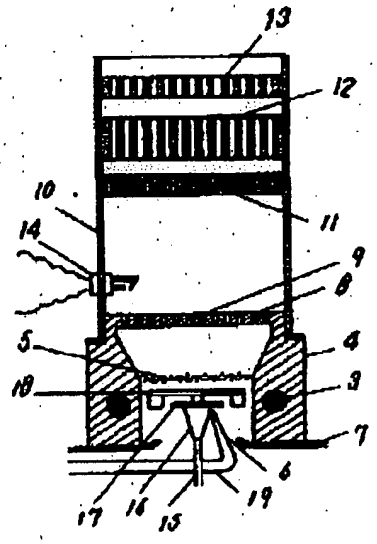
(54)**CATALYTIC BURNER**

(57)Abstract:

PURPOSE: To provide a catalytic burner which enables fuel to effect safe and efficient oxidizing reaction even under a wide range of air-fuel ratio, and makes exhaust gas clean, by a method wherein an oxidizing catalyst is located on the upperstream side of a premixture flow and a honeycomb type shielding plate made of a heat-resisting porous ceramic is situated on the downstream side.

CONSTITUTION: In a catalytic burner in which a catalyst 12 carriers one or more types of transition-metallic oxides, such as Ni, Co, Fe, Cr, on a carrier, a honeycomb type shielding plate 13, installed at an interval ahead of the catalyst 12, is heated by a radiant heat from the catalyst 12 and is simultaneously heated by a combustion exhaust gas flow, resulting in an increase in temperature to about 800W1,200°C. Thereafter, the catalyst 12 is reversely heated by a radiant heat from the honeycomb type shielding plate 13, and thereby the outer periphery and the front part of the catalyst 12 also hold activating temperature uniformly. Thus, premixture gas is perfectly oxidized on the catalyst 12, and a combustion condition is stablized.



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限の空燃は、空気量を増加させてCO_2濃度を低下させていった時に、排ガス中にCOが発生し始める限界のCO_2濃度（吹き飛び限界）を示し、両限界の差を燃焼幅と定義した。

図より、従来例の場合は、燃焼下限が高い位置にあり、特に低燃焼量領域でこの傾向が著しくなっている。すなわち高い空燃比に於ける燃焼が極めて不安定であることを示している。これに対し本実施例では、800～3200K cal／h まで比較的安定した燃焼幅（2.0～3.9 vol%）を保持しており、従来例と比べ、高い空燃比に於てもかなり安定燃焼が可能であることを示している。

発明の効果

本発明の触媒燃焼器によれば、次に列記する効果が得られる。

(1) 予混合気流の上流側に活化触媒を担持した触媒体、下流側に耐熱多孔質セラミックからなるハニカム式遮蔽板を、各々一定の間隔を置いて設置したことにより、ハニカム式遮蔽板が保熱板の役割を果たし、触媒体全体を活性化温度に保持するため、予混合ガスは完全酸化され、クリーンな排ガスを得ることができる。

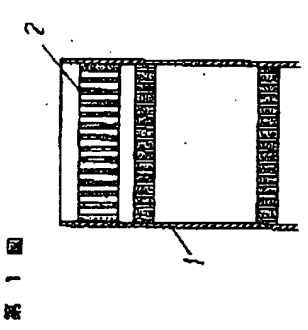
(2) 上記構成により、低燃焼量領域に於ても、従来より高い空燃比での安定燃焼が可能となり、結果的に幅広い燃焼幅を得ることが可能となった。

4、図面の簡単な説明

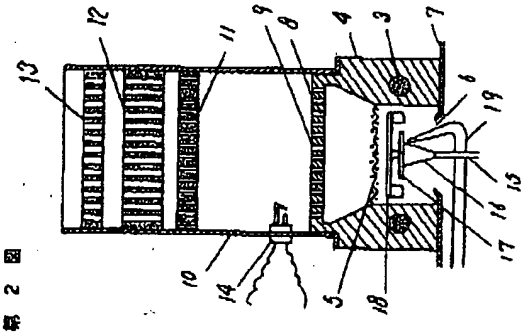
第1図は従来の触媒燃焼器の縦断面図、第2図は本発明による触媒燃焼器の一実施例の縦断面図、第3図は従来例と本発明実施例とを使用した場合の比較を示した図である。

12……触媒体、13……ハニカム式遮蔽板。

代理人の氏名 弁理士 中 尾 敏 男 ほか1名



第1図



第2図

Laid-open Publication No. S59-176509 (A)
Laid-open Publication Date: October 5, 1984
Title of the Invention: A catalyst combustor
Patent Application No. S58-51945
Filing Date: March 28, 1983
Inventor: Y. Shimada, I. Matsumoto
Applicant: Matsushita Electric Industrial Co., Ltd
Agent: T. Nakao, Attorney

S59-176509A

SPECIFICATION

1. TITLE OF THE INVENTION

A catalyst combustor

2. WHAT IS CLAIMED IS:

1. A catalyst combustor comprising:

a catalytic medium carrying an oxidation catalyst disposed in the upstream side along a flow of premixed gas containing a gaseous fuel or a vaporized liquid fuel mixed with a combustion air; and

a honeycomb-type shield plate made of heat-resistant porous ceramics disposed in the downstream side along said flow, said catalytic medium and said honeycomb-type shield plate being spaced from each other by a certain distance.

2. A catalyst combustor in accordance with claim 1,

in which said catalytic medium comprises a carrier and one or more type(s) of oxide of transition metal selected from a group consisting of Ni, Co, Fe and Cr, carried on said carrier.

3. A catalyst combustor in accordance with claim 1, in which said distance between said honeycomb shield and said catalytic medium is set to a certain distance so that a temperature of said honeycomb-type shield plate can be held in a range of 800 to 1200℃.

3. DETAILED DESCRIPTION OF THE INVENTION

Field of the invention

The present invention relates to a catalyst combustor, in which a variety type of gaseous fuel or a vaporized liquid fuel is premixed with a combustion air and then supplied over a catalytic medium so as to induce an oxidation reaction over a surface thereof to thereby generate heat, which will be in turn utilized.

Configuration of prior art example and problems associated therewith

A catalyst combustor according to the prior art comprises, as shown in Fig. 1, only a catalytic medium 2 simply disposed within a combustion cylinder 1, in which the catalytic medium 2 is exposed to a cooling effect from its contact with the combustion cylinder 1 as well as with the external air, resultantly developing a low

temperature region with a temperature lower than an activating temperature in an outer periphery and a front face of the catalytic medium 2. Accordingly, the prior art catalyst combustor has a drawback that a premixed gas passing through said low temperature region is likely to burn incompletely and consequently exhausted as unburned gas containing CO and so on. This trend could be observed significant especially with a high excess air ratio in a low combustion volume zone.

Object of the invention

The present invention is made to solve the above problems associated with the prior art, and an object thereof is to provide a catalyst combustor enabling a stable and efficient oxidation reaction of a fuel catalytic medium even under a wide range of air-fuel ratio, while producing a clean emission gas.

Configuration of the invention

To accomplish the above object, the present invention provides a catalyst combustor comprising a catalytic medium carrying an oxidation catalyst disposed in the upstream side along a flow of premixed gas, and a honeycomb-type shield plate made of heat-resistant porous ceramics disposed in the downstream side along said flow. Owing to this configuration, since the honeycomb-type shield plate is exposed to a radiation heat from the catalytic medium in burning state and also heated by an exhaust gas flow from combusting, a

temperature of the honeycomb-type shield plate rises up to a range of 800 to 1200℃. At this point of time, the catalytic medium is exposed to the radiation heat inversely from the heated honeycomb-type shield plate, and so the activating temperature can be retained even in an outer periphery as well as in a front face of the catalytic medium without subject to any cooling effect. Accordingly, the premixed gas is subject to a complete oxidation effect from the catalytic medium held at the activating temperature and consequently can be exhausted as a clean emission gas. As described above, the configuration according to the present invention enables the stable combustion to be carried out even with a higher air-fuel ratio than in the conventional manner and thus the combustible range and therefore the TDR to be extended.

Description of the embodiments

The present invention will now be described with reference to Fig. 2 illustratively showing an embodiment of a catalyst combustor according to the present invention.

A resistor plate 5 made of wire net or punching metal is installed in a vaporization and premixing cylinder 4 having a sheathed heater embedded therein, and the vaporization and premixing cylinder 4 in its rear portion is connected with a stationary plate 7 having an air hole 6 in a central region thereof. On the other hand, a blowout plate 9 having a number of blowout

holes 8 is mounted on a front portion of the vaporization and premixing cylinder 4 so as to form an integrated single unit therewith, and further a cylindrical combustion cylinder 10 made of heat-resistant metal is connected to the front portion of the vaporization and premixing cylinder 4. In the combustion cylinder 10 is installed a back fire preventive plate 11, a catalytic medium 12, and a honeycomb-type shield plate 13 according to the present invention, all of which are disposed in the above sequence in the forward direction with respect to the combustion cylinder 10. Further, an ignition plug 14 is arranged immediately in front of the blowout plate 9, which is penetrating through a wall of the combustion cylinder 10. On the other hand, a tip portion of a shaft 15 directed into the vaporization and premixing cylinder 4 is connected with a truncated cone 16 with a larger diameter directed forward, a rotary disk 17, and a mixing disk with a small stirring blade attached in its circumferential edge, all of which are securely arranged in this sequence. Furthermore, an oil feed pipe 19 is arranged such that a front end thereof is open toward the lateral surface of the cone 16.

An operation of the embodiment according to the above configuration will now be described.

After the sheathed heater 3 has been turned on and when the temperature in the sidewall of the vaporization and premixing cylinder 4 has reached a predetermined temperature, then a fan and an electromagnetic pump

(either of them not shown) are turned on to thereby initiate the supply of air and liquid fuel. The liquid fuel is fed onto the cone 16 in the revolving state by the oil feed pipe 19, and flows along the tapered surface of the cone 16 up to the rotary disk 17, where it flies circumferentially as fine particles with the aid of the turning force to impinge upon the sidewall of the vaporization and premixing cylinder 4 and evaporate immediately. On the other hand, the air that has been introduced by the fan is fed into the vaporization and premixing cylinder 4 through the air hole 6 and mixed evenly with the liquid fuel vaporized by the mixing disk 18 thus to form a premixed gas. The premixed gas is ignited at a point where it has just passed through the blowout plate 9 by the ignition plug 14 sparking through the electric power supply. Under this condition, the premixed gas receives the radiation heat from the flame and the heat transfer from the combustion cylinder 10, and reaches an activating temperature in the catalytic medium 12. Subsequently, when the supply of the fuel is once stopped to cease the flame followed by the re-starting of the fuel supply, the premixed gas starts to make a flame-less combustion without forming any flame on the catalytic medium 12 held in the activating temperature. At this time, the honeycomb-type shield plate 13 located in front of the catalytic medium 12 is exposed to the radiation heat from the catalytic medium 12 and also heated by an exhaust gas flow from the

combustion, and the temperature of the honeycomb-type shield plate 13 rises up to a range of 800 to 1200℃. After that, since the catalytic medium 12 receives the radiation heat inversely from the honeycomb-type shield plate 13, the outer periphery and the front surface of the catalytic medium 12 also can be held uniformly in the activating temperature. Therefore, the premixed gas can be completely oxidized on the catalytic medium 12 to provide a stable condition of combustion.

In order to provide data demonstrating the effect from the catalyst combustor of the present invention, Fig. 3 shows a difference in combustion characteristic between an application using the prior art example shown in Fig. 1 and an application using the embodiment of the present invention shown in Fig. 2. It is to be noted that both the prior art example and the embodiment of the present invention used for the evaluation had the same specification except that the embodiment of the present invention employed the honeycomb-type shield plate 13. ZrO_2 was employed as a base material for both of the catalytic medium 12 and the honeycomb shield plate 13, the oxidation catalyst of NiO was carried on the catalytic medium 12 by some percent, and the kerosene was used as a fuel. In Fig. 3, curves indicated by black dots represent the present invention, while curves indicated by white dots represent the prior art example, wherein each of the upper curves is indicative of a combustion upper limit and each of the lower curves

is indicative of a combustion lower limit. The combustion upper limit defines such a limit in CO_2 concentration in which if the air volume is reduced to increase the CO_2 concentration, the flame is formed behind the back fire preventive plate 11 and resultantly the flame-less combustion is no more attainable (i.e., the back fire limit), while the combustion lower limit defines such a limit in CO_2 concentration in which if the air volume is increased to reduce the CO_2 concentration, CO begins to be generated in the emission gas (i.e., the blow-off limit), wherein a combustion range is defined by a difference between said two limits.

It is seen from Fig. 3 that the combustion lower limit is found in a higher position for the prior art example and this trend is observed significant especially in the lower combustion volume zone. This indicates that the combustion with a higher air-fuel ratio is extremely unstable. In contrast to this, the embodiment of the present invention holds a relatively stable combustion range (3.0-3.9 vol%) over a combustion volume of 800 to 3200 Kcal/h, proving that the considerably stable combustion is attainable even with the high air-fuel ratio, as compared to the prior art example.

Effect of the invention

According to a catalyst combustor of the present invention, the below-listed effects could be obtained.

(1) Owing to a configuration of a catalyst combustor

in which a catalytic medium carrying an oxidation catalyst is disposed in the upstream side along a premixed gas flow and a honeycomb-type shield plate made of heat-resistant porous ceramics is disposed in the downstream side along said flow with a certain interval therebetween, the honeycomb-type shield plate takes a role of heat-retention plate to hold the entire catalytic medium at an activating temperature, and so the premixed gas can be completely oxidized and clean emission gas can be obtained.

(2) Owing to the above designated configuration, a stable combustion is made possible even in the low combustion volume zone with a higher air-fuel ratio than in the prior art, consequently enabling a wider combustion width to be obtained.

4. DESCRIPTION OF THE DRAWINGS

Fig. 1 is a longitudinal section view of a catalyst combustor according to the prior art;

Fig. 2 is a longitudinal section view of one embodiment of a catalyst combustor according to the present invention; and

Fig. 3 shows a comparison of effect between the prior art example and the embodiment of the present invention,

wherein reference numeral 12 designates a catalytic medium and 13 designates a honeycomb-type shield plate.

Name of agent: T. Nakao and one other, Attorney

TRANSPLATION OF THE WORDS IN THE DRAWING

[Fig. 3]

CO_2濃度: CO_2 concentration

灯油燃焼量: Kerosene combustion volume